



Technical Committee 184: Industrial automation systems and integration  
Subcommittee 4: Industrial data

TC 184/SC4 N793

**ISO Committee Draft Ballot Results**  
**for 10303-42 2<sup>nd</sup> Edition**  
**Product data representation and exchange - Integrated generic resources**  
**Geometric and topological representation.**

The ballot was circulated among SC4 members for its vote on 1998-06-29. 13 of our eighteen P-members responded to the ballot:

COUNTRY	VOTE	WITH COMMENT
Australia	Agree	
Canada		
China		
France	Disagree	X
Germany	Agree	X
Hungary		
Italy	Agree	
Japan		
Korea, Republic of	Agree	
Netherlands	Agree	
Norway	Agree	X
Portugal		
Russia	Agree	
Spain	Agree	
Sweden	Agree	
Switzerland	Abstain	
United Kingdom	Agree	X
United States	Agree	X

The Secretariat has reviewed the ballot responses, and in consultation with the Chair and concurrence from the project leader, proposes that, the next draft 10303-42 will go forward for registration as a DIS.

This document is also available digitally through SOLIS via ftp or www:

[http://www.nist.gov/sc4/step/parts/part042/cd/bal\\_cmt/](http://www.nist.gov/sc4/step/parts/part042/cd/bal_cmt/)

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## **BALLOT COMMENTS**

### **FRANCE**

Please remove the expression schema from this part and transfer it into PLIS part 20

### **GERMANY**

See attached - only available as "hard copy"

### **NORWAY**

DESCRIPTION: The current set of swept surfaces does not seem to cover all the requirements of maritime applications. In particular for the representation of profiles the following is needed. Some profiles are located on the inner side of the outer shell of a ship hull. These may with advantage be represented by a swept\_curve that is extruded along a curve in that outer shell surface. The orientation of the profile may then depend on the surface normal along the curve of extrusion (directrix). Thus, the profile could be kept e.g. perpendicular to the outer shell.

PROPOSED SOLUTION: A swept\_surface subtype that allows a swept\_surface definition taking into account the normal of the surface that the directrix is defined in.

### **UNITED KINGDOM**

See attached - only available as "hard copy"

### **UNITED STATES**

ISSUE: USA-42ed2 CD-1

AUTHOR: USA

CLAUSE: 6.4.13

CLASSIFICATION: Major Technical

DESCRIPTION: Informal Proposition #1 for the EDGE LOOP is violated for a valid topological representation of a spherical face. Consider the example of a FACE SURFACE composed of a SPHERICAL SURFACE and one (1) FACE BOUND.

The FACE BOUND is composed of one (1) EDGE LOOP and the EDGE LOOP is composed of two (2) ORIENTED EDGES as follows:

1. semi-circle down the seam of the sphere
2. semi-circle up the seam of the sphere

ORIENTED EDGES 1 and 2 share the same EDGE CURVE. The EDGE CURVE is composed of a B-SPLINE CURVE and two (2) VERTICES. Based on the algorithm specified in Part 42, the calculated genus is zero (0). This is in violation of IP1 which states that the genus must be 1 or greater. However, this is valid topological representation and to satisfy IP2, the genus must be zero (0).

PROPOSED SOLUTION:

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-2

AUTHOR: US - USA

CLAUSE: foreword - page xvii - table 1

CLASSIFICATION: major technical

STATUS:

DESCRIPTION: table states that the composite\_curve\_segment has been changed is now a sub type of geometric\_representation\_item, but in 4.4.39, composit\_curve\_segment is not a type of geometric\_representation\_item.

PROPOSED SOLUTION: either change the SEDS resolution, or change the composite\_curve\_segment.

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-3

AUTHOR: USA

CLAUSE: 7.5.14 maths\_function, p303

CLASSIFICATION: Major Technical

DESCRIPTION: The connection between the geometry schema and the mathematical representation schema should be restored. That is, the parametric functions defined for almost all geometry entities should be made available to the mathematical representation schema as instances of additional subtypes of maths\_function.

PROPOSED SOLUTION: Three new entity types, one for curves, one for surfaces, and one for volumes, each with one attribute identifying the geometric entity instance whose parametric function is being represented, should suffice.

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-4

AUTHOR: USA

CLAUSE: 4

CLASSIFICATION: Major Technical

DESCRIPTION: Add an entity type for the Clothoid curve. This addition was requested twice in my hearing by representatives from civil engineering, but apparently never formally submitted. I submit it now only so that it may be given a serious hearing during the comment resolution process in this round of revisions.

PROPOSED SOLUTION:

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-5

AUTHOR: USA

CLAUSE: 4, para 4.4.86, page 123

CLASSIFICATION: Major Technical

DESCRIPTION: The reducing\_toroidal\_volume as currently described presents serious problems.

- 1) Unlike all the other primitive volumes provided, the surface of this one cannot be rationally parametrized. Thus STEP cannot exchange surface information corresponding to the boundary of this primitive.
- 2) The curved surface of the volume as defined does not have the parallel offset property, so that (for example) subtraction of a corresponding volume with values of  $r_s$  and  $r_e$  differing by the same amount from the original values does not give rise to a duct with uniform wall thickness. This follows because the surface normal does not lie in the plane of the generating circles. Since one of the primary applications of this volume is for defining ducts, this is a severe disadvantage.
- 3) It is not possible to join the volume as defined with other cylindrical or conical volumes in such a way that their surfaces join smoothly.

PROPOSED SOLUTION: Define the volume as a segment of a Dupin cyclide. This is a well-studied generalization of the torus. Its surface has a rational biquadratic parametrization. Its parallel offsets are also Dupin cyclides, permitting the easy definition of ducts with constant wall thickness. A Dupin cyclide is also tangent to a cone (or cylinder) around all of its circular generators, which allows for smooth blending with other simple shapes. One existing CAD system and one known to be under development already implement the Dupin cyclide.

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-6

AUTHOR: Bill Anderson

CLAUSE: 4.4.39, pg 70, NOTE

CLASSIFICATION: Major Technical

DESCRIPTION: Since this document was published I believe Ray sent an email to WG12 indicating that at Bad Aibling it was decided to replace this by EXPRESS and WRs. The following email sent to Ray Goult gives the rationale and background for recommending proposal (4) by Tony Ranger to replace the EXPRESS and WRs. This is supported by PDES, Inc. STEPnet and ProSTEP Round Table.

Tony's proposed is to define a new entity and the text that follows:

```
ENTITY composite_curve_segment_item SUBTYPE OF (composite_curve_segment,
geometric_representation_item ); END_ENTITY;
```

"The composite\_curve\_segment would be made a supertype of composite\_curve\_segment\_item, with either composite\_curve\_segment\_item or its parent being instantiated in the Part 21 file. Thus, composite\_curve\_segment\_item would inherit the attributes: transition, same\_sense, parent\_curve. It will also get a name attribute from representation\_item, which will appear at the end of the list. The use of composite\_curve\_segment would be deprecated in all future mappings."

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Dear Ray,

Based on my review of Part 42 version 2 we had discussions at PDES, Inc. offsite recently on the NOTE for composite\_curve\_segment and specifically your later decision on replacing it with WHERE rules, etc. After discussing alternatives described in this email, Tony Ranger proposed (4) below as an alternative, and the members of STEPnet and ProSTEP expressed approval. The following message was then sent last Thursday to the entire STEPnet and Round Table to ask for any comments. Markus Hauser of ProSTEP discuss with the full Round Table and they fully support (4) and I appended his message (received Friday) at the end of this email. I will be writing a summary of this as a ballot comment to Part 42. In case you were leaving for Beijing soon I wanted to get this to you prior to your leaving, so you would have it for any discussion in your Shape Representation Committee. We hope that you can support this proposal. I will not be attending the Beijing meeting, but Larry McKee will be there from STEPnet/PDES, Inc. Best regards, Bill.

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STEPnet and Round Table,

Part 42 version 2 is out for its CD ballot with U.S. comments due by Friday 25 Sept, so from my perspective any input from you is needed by Friday. I will briefly summarize an issue that involves upward compatibility. If you recall there was a SEDS issues (#5) identified by Shantanu Dhar which stated:

Due to the fact that composite\_curve\_segment is not a subtype of representation\_item it is not possible to instantiate a composite\_curve without having its attribute parent\_curve violate WR1 of representation\_item.

(Note that the same problem exists for surface\_path and a similar resolution should be applicable to it-to save time only composite\_curve\_segment is discussed)

This affects ONLY CC2 of AP203 and any Conformance Class of AP 214 that uses the geometrically\_bounded\_wireframe AIC. This particular problem has a somewhat lengthy history, which I won't review here, but will briefly describe what I believe to be the current situation and alternatives:

(1) Ray proposed to resolve/correct this by making composite\_curve\_segment a subtype of geometric\_representation\_item, but this was NOT non-upward compatible, which was not acceptable to many people. Ray agreed to remove the subtyping and put in text to address the problem in the form of the following note, which currently appears in Part 42 version 2 for composite\_curve\_segment:

NOTE - Since composite\_curve\_segment is not a subtype of geometric\_representation\_item the instance of bounded\_curve used as parent\_curve is not automatically associated with the

geometric\_representation\_context of the representation using the composite\_curve containing this composite\_curve\_segment. It is therefore necessary to ensure that the bounded\_curve instance is explicitly included in a representation with the appropriate geometric\_representation\_context.

(2) Ray sent an email to WG12 after the summer ISO meeting and I believe this was forwarded to you. It stated: During the Bad Aibling meeting it was agreed in the Shape Representation committee that it was preferable to replace the proposed notes added to composite\_curv\_segment (the NOTE in (1) above I believe) and surface\_patch as an upward compatible resolution of SEDS 5 with additional WRs.

The where rule EXPRESS for WR2 was given along with the description and NOTE:

WR2: The parent\_curve shall be explicitly included in representations with the same context as those of the using\_curves.

NOTE - Since composite\_curve\_segment is not a subtype of geometric\_representation\_item the instance of bounded\_curve which is the parent\_curve attribute is not automatically associated with the geometric\_representation\_context of each representation using a composite\_curve containing this composite\_curve\_segment.

Number (2) text is more explicit than the text in (1), and WR2 (with NOTE) were discussed last week at the PDES, Inc. offsite with representatives from STEPnet and the Round Table. Using a Part 21 example, the main OBJECTION with (2) was that there is unwanted duplication if both the composite\_curve and parent\_curve are explicitly included in the representation (e.g., geometrically\_bounded\_wireframe\_shape\_representation). Al Montano noted that, specifically, the parent\_curve of the composite\_curve\_segment essentially becomes both a part of the composite\_curve\_segment and an independent representation\_item since it hangs off of a representation directly. Because of this, we would have an unwanted duplication of the parent\_curve (one in the context of a composite\_curve, and one independently). There would be no way to instantiate composite\_curves based on this without duplicating the parent\_curve independently.

(3) We also discussed an informal proposition from Al:

Even though the parent\_curve of a composite\_curve\_segment is not explicitly associated with representation\_context, in its use as a parent curve of the composite\_curve\_segment, it shall be inferred to be in the same context as the composite\_curve referencing the composite\_curve\_segment.

In (3) it was not intended to explicitly place the parent\_curve in the representation, but it was 'inferred' to have to have the same same context as composite\_curve.

Al also brought up about possibly changing WR1 of representation\_item to make an exception for the parent\_curve of a composite\_curve\_segment and doing the analogous thing for the surface\_patch. I had brought up this same idea to the Integrated Resources workshop several months ago and it was turned down.

(4) After discussing (3) Al mentioned that he didn't like some of the wording we seem forced to use here. To help resolve this Tony Ranger proposed defining a new entity:

```
ENTITY composite_curve_segment_item
SUBTYPE OF (composite_curve_segment, geometric_representation_item );
END_ENTITY;
```

"The composite\_curve\_segment would be made a supertype of composite\_curve\_segment\_item, with either composite\_curve\_segment\_item or its parent being instantiated in the Part 21 file. Thus, composite\_curve\_segment\_item would inherit the attributes: transition, same\_sense, parent\_curve. It will also get a name attribute from representation\_item, which will appear at the end of the list. The use of composite\_curve\_segment would be deprecated in all future mappings."

The bottom line is that everyone was in agreement that (4) was the best alternative under consideration. If you have any serious objections (or even concurrence), please let me know by Friday 25 Sept; otherwise, I will propose (4) as an alternative to the current NOTE in Part 42 version 2 for addressing SEDS #5.

Best regards, Bill

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Dear all,  
the ProSTEP round Table met this week and discussed the issue. In alignment with the discussions at the PDES offsite/STEPnet meeting, the participants of the ProSTEP Round Table also strongly support the solution alternative 4 (the new entity proposed by Tony Ranger)

Best regards,

Markus

(4) After discussing (3) Al mentioned that he didn't like some of the wording we seem forced to use here. To help resolve this Tony Ranger proposed defining a new entity:

```
ENTITY composite_curve_segment_item
SUBTYPE OF (composite_curve_segment, geometric_representation_item );
END_ENTITY;
```

"The composite\_curve\_segment would be made a supertype of composite\_curve\_segment\_item, with either composite\_curve\_segment\_item or its parent being instantiated in the Part 21 file. Thus, composite\_curve\_segment\_item would inherit the attributes: transition, same\_sense, parent\_curve. It will also get a name attribute from representation\_item, which will appear at the end of the list. The use of composite\_curve\_segment would be deprecated in all future mappings."

The bottom line is that everyone was in agreement that (4) was the best alternative under consideration. If you have any serious objections (or even concurrence), please let me know by Friday 25 Sept; otherwise, I will propose (4) as an alternative to the current NOTE in Part 42 version 2 for addressing SEDS #5.

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-7

AUTHOR: USA

CLAUSE: 7

CLASSIFICATION: Major Technical

DESCRIPTION: There should be many more examples give in use of this schema, e.g. how to use this schema to exchange variables and equations in a Part 21 file (assuming that is supported and not just a rumor). It is quite abstract and more examples would help shows it capabilities.

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-8

AUTHOR: USA

CLAUSE: 4.4.11 spherical\_point, p32

CLASSIFICATION: Minor Technical

DESCRIPTION: Names for attributes "theta" and "phi" should be swapped or replaced. The technical community is divided in its use of these two Greek letters for the polar angle and equatorial angle components of the spherical coordinate triple. For example, the Mathematics Dictionary by James and James uses theta for the polar angle, while the CRC Handbook uses phi for the polar angle. Both references also mention the reverse usage.

PROPOSED SOLUTION: Using theta for the equatorial angle would make spherical\_point's usage consistent with both polar\_point and cylindrical\_point (i.e. theta is the angle in the x-y plane and ranges from 0 to 360 degrees in all three), and should therefore be preferred.

Alternatively, non-ambiguous names such as polar\_angle and equatorial\_angle could be substituted.

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-9

AUTHOR:USA

CLAUSE: 7.5.1 maths\_space, p296; 7.5.14 maths\_function, p303; 7.5.18; 7.5.23; 7.5.24

CLASSIFICATION: Minor Technical

DESCRIPTION: What is the meaning of an instance of these entity types which is not also an instance of a subtype? These types were originally designed as "abstract" types, i.e. not capable of instantiation by themselves. For still obscure philosophical reasons, abstract types were not permitted in Integrated Resources. This rule causes the stated problem.

PROPOSED SOLUTION: Restore them to "abstract" status.

RESOLUTION:

ISSUE NUMBER: USA-42es2 CD-10

AUTHOR: USA

CLAUSE: 4.2.4, pg 15 & 5.4.5 pg 183

CLASSIFICATION: Minor Technical

DESCRIPTION: In 5.4.5 there is discussion about geometric direction of a curve versus the topological direction. The geometric direction of a curve is intended, I believe, to be the direction of increasing parametrization. It seems that geometric (or curve) direction should be defined in 4.2.4 or close by, but I couldn't find it.

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-11

AUTHOR: USA

CLAUSE: 5.5.3, pg 211, 1st line of EXPRESS

CLASSIFICATION: Minor Technical

DESCRIPTION: ECCO compiler flagged an error in use of path as argument. From the function path should be replaced by a\_path

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-12

AUTHOR: USA

CLAUSE: 4.4.35, pg 62, NOTES 1 and 2

CLASSIFICATION: Major Editorial

DESCRIPTION: NOTES 1 and 2 should be indented; otherwise, one cannot determined where the NOTES end and normative text begins (e.g., Is the sentence 'No other data ... given' normative or part of NOTE 1? For clarification the sentence after NOTE 2 (I believe it is not intended to part of NOTE 2) should have the phrase 'of degree d' inserted as follows: To define a piecewise Bezier curve of degree d as a B-spline.

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-13

AUTHOR: USA

CLAUSE: Foreword, pg xx, Table 1

CLASSIFICATION: Major Editorial

DESCRIPTION: There are some errors or incomplete information in the table. Composite\_curve\_segment is NOT a subtype of geometric\_representation\_item; that was true in an earlier version, but that was not upward compatible and was withdrawn. The SEDS numbers and AP numbers need clarification. I believe all numbers in the 200's (e.g., 209, 210) should be preceded by 'AP'.

RESOLUTION:

ISSUE NUMBER: USA-42ed2 CD-14

AUTHOR: USA





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